

Gradient Corporation

MEMORANDUM

To: Jeff Dodd
U.S. EPA Region III

From: David Merrill

Subject: Input Parameters for the CRG Calculation

cc: Ken Brown, Dr. Singh, Mike Last, Laura Ahern

August 23, 1995

As you requested, I have summarized below the input parameters that were used in the CRG calculations which were reported in Table 10 of my August 2, 1995 memorandum, and which we discussed during the meeting held on August 8, 1995. Please don't hesitate to call if you need any additional information.

The parameters needed to calculate the CRG are:

- the geometric mean (η)
- the geometric standard deviation (γ)
- the exposure (concentration) reduction (α) required to achieve the cleanup goal (CUG)¹
- the H-statistic 95% UCLM
- the "clean" fill values (c_o)

where the notation used here is the same as that used in the paper by Bowers *et al.* (1994). In general, the geometric mean (geomean) and geometric standard deviation (GSD) are defined as:

$$\eta = \exp(\mu)$$

$$\gamma = \exp(\sigma)$$

where μ and σ are the mean and standard deviation of the log-transformed Site concentration data, summarized in Table 1 of the August 2 memorandum. The H-statistic 95% UCLM values were also summarized in Table 1, and the values for "clean fill" (c_o) were given in Table 10 of that memorandum.

The exposure reduction (α) is given by (Bowers *et al.*, p. 4):

$$\alpha = \chi'/\chi \quad (1)$$

where χ' and χ are the "post-remediation" and "pre-remediation"² arithmetic mean concentrations, respectively. In terms of the cleanup levels and the 95% UCLM, this exposure reduction is:

¹We have used the term target cleanup level (TCL) in earlier materials, CUG is used here to be consistent with the notation in the Bowers *et al.* (1994) paper.

²The terms post- and pre-remediation are those used in the Bowers *et al.* paper and their use here does not imply that actual remediation or soil removal is required. The notation here (χ) differs from that used in the paper (μ) to avoid confusion with the notation used earlier for the mean of the log-transformed data.

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$$\alpha = \text{CUG} + \text{H-statistic 95\% UCLM} \quad (2)$$

where χ' is equated to the cleanup goal, and χ is assumed to be as high (conservatively) as the H-statistic 95% UCLM.³ For the METCOA data, α was calculated using equation (2) for both the EPA and MO/AR cleanup (CUG) values. The values of η and γ corresponding to the case where the true mean is assumed to be as high as the H-statistic 95% UCLM are defined in Bowers *et al.*: $\eta = \text{UCL}_{95}$ and $\gamma = \text{gsd}_r$. The values of UCL_{95} and gsd_r are calculated using equation (6) and equation (7) in Bowers *et al.* I have tabulated the parameter values used in the CRG calculation in the table below:

Parameter	H-Statistic 95% UCLM	Geomean ($\eta = \text{UCL}_{95}$)	GSD ($\gamma = \text{gsd}_r$)	CRG for EPA CUG	CRG for MO/AR CUG
Fenced Area	<i>All values in (mg/kg)</i>				
Cadmium	2,675	204.60	9.65	8,211	32,407
Nickel	46,425	1,326.22	14.39	341,017	816,246
Perimeter & Fenced					
Cadmium	1,733	109.23	10.50	15,508	137,933
Nickel	33,458	472.35	18.52	1,038,592	3,558,088
All Surface Samples					
Cadmium	1,539	79.46	11.41	21,649	272,781
Nickel	27,023	331.55	19.43	1,915,055	9,408,419

As noted in Table 10 of the August 2, 1995 memorandum, the values for the cleanup goals (CUG) and "clean fill" were:

	<u>Nickel</u>	<u>Cadmium</u>
CUG (mg/kg)	13,000 (EPA) 18,584 (MO/AR)	700 (EPA) 1,307 (MO/AR)
Clean fill (c.)	11.3 mg/kg	5.0 mg/kg

³As noted in the Bowers *et al.* paper (p. 9), the CRG does not always occur when χ is set equal to the 95% UCLM as suggested by equation (2). For the METCOA data, the CRG does occur when equation (2) applies.